Glanbia Gooding 400 hp Boiler (Boiler 5 - WWTF)

Rated Boiler Heat Input (MMBtu/hr)	**16.7375**
Primary Fuel Type	**Biogas**
Max Biogas Production (scf/day)	**505,000**
Existing Max Biogas Production (scf/day)	**433,823**
Net Increase Biogas Production (scf/day)	**71,177**
Biogas Heat Value (Btu/scf)	**650**
Max Additional Biogas Fuel Use (scf/min)	**49**
Operation (hrs/yr)	**8,760**
Hydrogen Sulfide (H_2S) Biogas Concentration (ppmv)	**1,799**
H_2S Biogas Concentration (mg/m^3)	**2,509**
Max Additional H_2S Mass Feedrate (lb/hr)	**0.5**
Assumed H_2S Conversion for SO_2 Emissions	**100%**

				Uncontrolled Potential to Emit				
				Primary Fuel - Biogas				
Toxic Air Pollutants - H_2S	**CAS No.**	**Emission Factor [4] (% Destruction)**		**Emission Rate (lb/hr)**	**Emission Rate (lb/yr)**	**Emission Rate (ton/yr)**	**IDAPA 58.01.01.585/586 - EL (lb/hr)**	**PTE Emission Rate vs. EL**
Hydrogen sulfide	7783-06-4	98%		9.28E-03	8.58E+03	4.29E+00	9.33E-01	Below

				Uncontrolled Potential to Emit				
				Primary Fuel - Biogas [5]				
Toxic Air Pollutants - Non-metals [7]	**CAS No.**	**EPA AP-42 Natural Gas Emission Factor (lb/10^6 scf)**	**SCAQMD [6] Digester Gas Emission Factor (lb/10^6 scf)**	**Emission Rate (lb/hr)**	**Emission Rate (lb/yr)**	**Emission Rate (ton/yr)**	**IDAPA 58.01.01.585/586 - EL (lb/hr)**	**PTE Emission Rate vs. EL**
3-Methylchloranthrene	56-49-5	1.80E-06		5.34E-09	4.68E-05	2.34E-08	2.50E-06	Below
Ammonia	7664-41-7		3.20E+00	9.49E-03	8.31E+01	4.16E-02	1.20E+00	Below
Benzene	71-43-2	2.10E-03	5.80E-03	1.72E-05	1.51E-01	7.53E-05	8.00E-04	Below
Benzo(a)pyrene	50-32-8	1.20E-06		3.56E-09	3.12E-05	1.56E-08	2.00E-06	Below
Formaldehyde	50-00-0	7.50E-02	1.23E-02	2.22E-04	1.95E+00	9.74E-04	5.10E-04	Below
Hexane	110-54-3	1.80E+00		5.34E-03	4.68E+01	2.34E-02	1.20E+01	Below
Naphthalene	91-20-3	6.10E-04		1.81E-06	1.58E-02	7.92E-06	3.33E+00	Below
PAHs	na		4.00E-04	1.19E-06	1.04E-02	5.20E-06	9.10E-05	Below
Pentane	109-66-0	2.60E+00		7.71E-03	6.75E+01	3.38E-02	1.18E+02	Below
Toluene	108-88-3	3.40E-03		1.01E-05	8.83E-02	4.42E-05	2.50E+01	Below
2-Methylnaphthalene	91-57-6	2.40E-05		7.12E-08	6.24E-04	3.12E-07		
7,12-Dimethylbenz(a)anthracene		1.60E-05		4.75E-08	4.16E-04	2.08E-07		
Acenaphthene	92-32-9	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Acenaphthylene	203-96-8	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Anthracene	120-12-7	2.40E-06		7.12E-09	6.24E-05	3.12E-08		
Benz(a)anthracene	56-55-3	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Benzo(b)fluoranthene	205-99-2	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Benzo(g,h,i)perylene	191-24-2	1.20E-06		3.56E-09	3.12E-05	1.56E-08		
Benzo(k)fluoranthene	205-82-3	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Butane	106-97-8	2.10E+00		6.23E-03	5.46E+01	2.73E-02		
Chrysene	218-01-9	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Dibenzo(a,h)anthracene	53-70-3	1.20E-06		3.56E-09	3.12E-05	1.56E-08		
Dichlorobenzene	25321-22-6	1.20E-03		3.56E-06	3.12E-02	1.56E-05		
Ethane	74-84-0	3.10E+00		9.19E-03	8.05E+01	4.03E-02		
Fluoranthene	206-44-0	3.00E-06		8.90E-09	7.79E-05	3.90E-08		
Fluorene	86-73-7	2.80E-06		8.30E-09	7.27E-05	3.64E-08		
Indeno(1,2,3-cd)pyrene	193-39-5	1.80E-06		5.34E-09	4.68E-05	2.34E-08		
Phenanathrene	85-01-8	1.70E-05		5.04E-08	4.42E-04	2.21E-07		
Propane	74-98-6	1.60E+00		4.75E-03	4.16E+01	2.08E-02		
Pyrene	129-00-0	5.00E-06		1.48E-08	1.30E-04	6.49E-08		

Criteria Pollutant	CAS No.	Emission Factor [1] (lb/MM Btu)	(lb/MMscf)	Uncontrolled Potential to Emit — Additional Biogas — Emission Rate (lb/hr)	Emission Rate (lb/yr)	Emission Rate (ton/yr)
Total Particulate Matter (PM) [2]		0.010		0.02	169	0.1
Nitrogen Oxides (NOx)		0.118		0.23	1,993	1.0
Sulfur Dioxide (SO_2) [3]		mass balance		0.87	7,642	3.8
Carbon Monoxide (CO)		0.150		0.29	2,533	1.3
VOC		0.016		0.03	270	0.1
Lead			5.00E-04	1.48E-06	1.30E-02	6.49E-06

Toxic Air Pollutants-Metals [8]	CAS Number	Emission Factor (lb/10^6 scf)		Uncontrolled Potential to Emit — Primary Fuel - Biogas — Emission Rate (lb/hr)	Emission Rate (lb/yr)	Emission Rate (ton/yr)	IDAPA 58.01.01.585/586 - EL (lb/hr)	PTE Emission Rate vs. EL
Arsenic	7440-38-2	2.00E-04		5.93E-07	5.20E-03	2.60E-06	1.50E-06	Below
Barium	7440-39-3	4.40E-03		1.30E-05	1.14E-01	5.72E-05	3.30E-02	Below
Beryllium	7440-41-7	1.20E-05		3.56E-08	3.12E-04	1.56E-07	2.80E-05	Below
Cadmium	7440-43-9	1.10E-03		3.26E-06	2.86E-02	1.43E-05	3.70E-06	Below
Chromium	7440-47-3	1.40E-03		4.15E-06	3.64E-02	1.82E-05	3.30E-02	Below
Cobalt	7440-48-4	8.40E-05		2.49E-07	2.18E-03	1.09E-06	3.30E-03	Below
Copper	7440-50-8	8.50E-04		2.52E-06	2.21E-02	1.10E-05	1.30E-02	Below
Manganese	7439-96-5	3.80E-04		1.13E-06	9.87E-03	4.94E-06	6.70E-02	Below
Mercury	7439-97-6	2.60E-04		7.71E-07	6.75E-03	3.38E-06	1.00E-03	Below
Molybdenum	7439-98-7	1.10E-03		3.26E-06	2.86E-02	1.43E-05	3.33E-01	Below
Nickel	7440-02-0	2.10E-03		6.23E-06	5.46E-02	2.73E-05	2.75E-05	Below
Selenium	7782-49-2	2.40E-05		7.12E-08	6.24E-04	3.12E-07	1.30E-02	Below
Vanadium	1314-62-1	2.30E-03		6.82E-06	5.98E-02	2.99E-05	3.00E-03	Below
Zinc	7440-66-6	2.90E-02		8.60E-05	7.53E-01	3.77E-04	3.33E-01	Below

Notes:

[1] Criteria Pollutants emission rates from manufacturer-supplied emission factors, which are more conservative (higher) than EPA AP-42 factors. Except for Lead, which is from EPA AP-42, Section 1.4 Natural Gas Combustion, Table 1.4-2.

Same emission factor applied for biogas and natural gas combustion (similar properties)...no biogas emission factors available

[2] PM emission factor is assumed to equal PM_{10}.

[3] SO_2 Emission factor for biogas assumes 100% conversion of H_2S to SO_2 ; manufacturer SO_2 emission factor not used

[4] Conservatively estimated H_2S destruction based on engineering judgement and combustion properties of H_2S

[5] Biogas toxic air pollutant emissions based on EPA AP-42 emission factors, times ratio of Biogas heat value to natural gas heat value, unless higher emisson factor available through SCAQMD.

[6] Emission factors from "General Instruction Book for the 2003 - 2004 Annual Emissions Reporting Program", Table 10 (Default Emission factors for Digester Gas Combustion) South Coast Air Quality Managment District (SCAQMD).

[7] Toxic Air Pollutants (EPA AP-42, Section 1.4 Natural Gas Combustion, Table 1.4-3).

[8] Metals from Natural Gas Combustion (EPA AP-42, Section 1.4 Natural Gas Combustion, Table 1.4-4).

Glanbia Gooding Biogas Flare

Heat Input Increase (MMBtu/hr)	**1.93**	
Manufacturer	**Biothane**	
Fuel Type	**Biogas**	
Fuel Heat Value (Btu/scf)	**650**	
Max Biogas Production (scf/day) (based on highest expected sulfate concentration)	**505,000**	**(Used for SO2 emissions only, existing permit does not include SO2 emissions for flare only)**
Existing Max Biogas Production (scf/day)	**433,823**	
Net Increase in Max Biogas Production (scf/day)	**71,177**	**(Used to calculate all emissions except SO2)**
Max Increase Fuel Use (scf/min)	**49**	**(All emissions except SO2)**
Max Increase Fuel Use (scf/min)	**351**	**(SO2 only)**
Secondary Fuel Type	**Natural Gas**	
Natural Gas Heat Value (Btu/scf) (for emission factor conversion)	**1,056**	
Operation (hrs/yr)	**8,760**	
Hydrogen Sulfide (H_2S) Biogas Concentration (ppmv)	**1,799**	
H_2S Biogas Concentration (mg/m^3)	**2,509**	
H_2S Mass Feedrate -Max Biogas production (lb/hr)	**3.3**	**(SO2 only)**
H_2S Mass Feedrate (lb/hr)	**0.5**	
Assumed H_2S Conversion for SO_2 Emissions	**90%**	

				Uncontrolled Potential to Emit		
Criteria Pollutant	**CAS No.**	**Emission Factor [1]**		**Emission Rate (lb/hr)**	**Emission Rate (lb/yr)**	**Emission Rate (ton/yr)**
Total Particulate Matter (PM) [2]		7.6	lb/MM cf NG	0.014	122	0.06
Nitrogen Oxides (NOx)		0.068	lb/MM Btu	0.131	1,148	0.57
Sulfur Dioxide (SO_2) [3]		H_2S / SO_2 Mass Balance		5.57	48,801	24.40
Carbon Monoxide (CO)		0.37	lb/MM Btu	0.713	6,248	3.12
VOC		0.06	lb/MM Btu	0.121	1,064	0.53

				Primary Fuel - Biogas Uncontrolled Potential to Emit				
Toxic Air Pollutants - H_2S	**CAS No.**	**Emission Factor [4] (% Destruction)**		**Emission Rate (lb/hr)**	**Emission Rate (lb/yr)**	**Emission Rate (ton/yr)**	**IDAPA 58.01.01.585/586 - EL (lb/hr)**	**PTE Emission Rate vs. EL**
Hydrogen sulfide	7783-06-4	90%		4.64E-02	7.88E+03	3.94E+00	9.33E-01	Below

				Primary Fuel - Biogas [5] Uncontrolled Potential to Emit				
Toxic Air Pollutants - Others [5]	**CAS No.**	**Digester Gas Emission Factor (lb/10^6 scf)**	**Natural Gas Emission Factor (lb/10^6 scf)**	**Emission Rate (lb/hr)**	**Emission Rate (lb/yr)**	**Emission Rate (ton/yr)**	**IDAPA 58.01.01.585/586 - EL (lb/hr)**	**PTE Emission Rate vs. EL**
Ammonia	7664-41-7	3.20E+00		9.49E-03	8.31E+01	4.16E-02	1.20E+00	Below
Benzene	71-43-2	1.59E-01	1.59E-01	4.72E-04	4.13E+00	2.07E-03	8.00E-04	Below
Formaldehyde	50-00-0	1.17E+00	1.17E+00	3.47E-03	3.04E+01	1.52E-02	5.10E-04	**Exceeds**
PAHs	na	1.40E-02	1.40E-02	4.15E-05	3.64E-01	1.82E-04	9.10E-05	Below

Notes:

[1] Criteria pollutants emission rates from AP-42, Section 13.5 (Industrial Flares) w/ exception of PM and SO_2 (see below).

[2] PM emissions based on natural gas combustion, per AP-42 Table 1.4-2, due to extreme range and concentration-based format of industrial flare PM factors

[3] SO_2 Emission factor for biogas assumes 90% conversion of H_2S to SO_2. Natural gas SO2 factor based on AP-42, Table 1.4-2.

[4] Conservatively estimated H_2S destruction based on engineering judgement and combustion properties of H_2S

[5] Emission factors from "General Instruction Book for the 2003 - 2004 Annual Emissions Reporting Program", Tables 4 and 10, South Coast Air Quality Managment District (SCAQMD).

Flare Burner Maximum Flow Rate

m3/hr	m/s	area (m2)
1180	10.11259	0.032413
0.327778		
m3/s	0.327778	
4248000		

Flare Equivalent Diameter and Stack Height calculations

The equivalent stack diameter uses the net heat release.
$d = 9.88 \times 10^{-4} (q_n)^{½}$

The net heat release uses the heat release of the biogas from the flare
$q_n = (0.45)\ q$
q = gross heat release from the flare (cal/s)
qn = net heat release from the flare (cal/s)

q= Max bio gas production (505,000 scf/day) x Fuel heat value (650 BTU/scf)
328,250,000.00 BTU/day
= [328,250,000 BTU/day x 252 cal/BTU] / [24*3600 seconds/ day]

q	957,396	cal/s

q_n = 0.45 *957,396 cal/s

qn	430,828	cal/s

Now that the value for the new heat release of the biogas is determined, the equivalent diameter is
$d = 9.88 \times 10^{-4} (430{,}828\ \text{cal/s})^{½}$

d	0.65	meters

The physical stack height of the flare is adjusted in the EPA method by adding the length of the flame to the height of the top of the flare structure using the formula:
$H_a = H_s + [(4.56 \times 10^{-3})(q^{0.478})]$
H_a = Adjusted flare height (m)
H_s = Physical flare height (m)
q= gross heat release (cal/s) input by user

$H_a = 4.87\ \text{m} + [(4.56 \times 10^{-3})(957{,}396\ \text{cal/s}^{0.478})]$

Ha	8.17 m

Default Stack Temperature and Stack velocity

Temperature	1273	K
Velocity	20	m/s

Sources:
EPA, SCREEN3, Model User's Guide, EPA 454/B-95-004, September 1995

Appendix C

Manufacturer Information

CLEAVER BROOKS
The power of commitment.

Cleaver-Brooks Boiler Estimated Exhaust/Emission Performance Data

Customer:	Glanbia Foods
Location:	Gooding , ID
Prepared By:	L.C. Banks
Elevation, feet:	3573
Date:	06/09/08
Boiler Type:	Steam
Steam Pressure, psig:	125
LE Option, ppm:	Uncontrolled

Boiler Built After 1990

Boiler Summary Data

Boiler Model:	CB-600-150ST
Fuel:	Natural Gas
Input, Btu/hr:	25,106,000

		Firing Rate 25%	50%	75%	100%
	Horsepower	150	300	450	600
	Btu/hr	6,276,500	12,553,000	18,829,500	25,106,000
Emission Performance					
CO	ppm	150	50	50	50
	lb/MMBtu	0.109	0.036	0.036	0.036
	lb/hr	0.69	0.46	0.69	0.92
	tpy	3.01	2.01	3.01	4.01
NOx	ppm	100	100	100	100
	lb/MMBtu	0.117	0.117	0.117	0.117
	lb/hr	0.73	1.47	2.20	2.94
	tpy	3.22	6.43	9.65	12.87
SOx	ppm	1	1	1	1
	lb/MMBtu	0.0017	0.0017	0.0017	0.0017
	lb/hr	0.011	0.021	0.032	0.042
	tpy	0.05	0.09	0.14	0.18
HC/VOCs	ppm	10	10	10	10
	lb/MMBtu	0.004	0.004	0.004	0.004
	lb/hr	0.025	0.050	0.075	0.100
	tpy	0.11	0.22	0.33	0.44
PM_{10}	ppm	N/A	N/A	N/A	N/A
	lb/MMBtu	0.01	0.01	0.01	0.01
	lb/hr	0.063	0.126	0.188	0.251
	tpy	0.27	0.55	0.82	1.10
Exhaust Data					
Temperature, F		365	375	380	390
Flow	ACFM	2,497	4,341	6,551	8,842
	SCFM	1,443	2,478	3,718	4,957
	lb/hr	6,491	11,147	16,721	22,294
Velocity	ft/sec	13.25	23.03	34.76	46.91
	ft/min	794.8	1381.7	2085.3	2814.4

Notes:

1.) All ppm levels are corrected to 3 %, oxygen level
2.) Fuel input is based on 80% boiler efficiency.
3.) Particulate is exclusive of any particulates in combustion air or other sources of residual particulates from material.
4.) Emission produced in tons per year (tpy) is based on 24 hours per day for 365 days = 8,760 hours per year
5.) Exhaust data is based on a clean and properly sealed boiler.
6.) Emission data is based on a burner turndown of 4 to 1.

Biothane Corporation

5/27/04

BOILER EMISSION ESTIMATE

Customer:	Biothane
Location:	
Prepared By:	Duane Rotkosky
Elevation, feet:	100
Date:	05/13/04

Boiler Summary Data

Boiler Model:	CEW700-400-HW	Boiler Type:	Hot Water
Fuel:	Natural Gas	Hot Water Temp, F:	200
Input, Btu/hr:	16,737,500	LN Option, ppm:	None

		Firing Rate			
		25%	50%	75%	100%
Horsepower		100	200	300	400
Btu/hr		4,184,375	8,368,750	12,553,125	16,737,500
Emission Performance					
CO	ppm	200	200	200	200
	lb/MMBtu	0.150	0.150	0.150	0.150
	lb/hr	0.63	1.26	1.88	2.51
	tpy	2.75	5.50	8.25	11.00
NOx	ppm	100	100	100	100
	lb/MMBtu	0.118	0.118	0.118	0.118
	lb/hr	0.49	0.98	1.48	1.97
	tpy	2.16	4.31	6.47	8.62
SOx	ppm	1	1	1	1
	lb/MMBtu	0.001	0.001	0.001	0.001
	lb/hr	0.004	0.008	0.013	0.017
	tpy	0.02	0.04	0.05	0.07
HC/VOCs	ppm	40	40	40	40
	lb/MMBtu	0.016	0.016	0.016	0.016
	lb/hr	0.067	0.134	0.201	0.268
	tpy	0.29	0.59	0.88	1.17
PM	ppm	N/A	N/A	N/A	N/A
	lb/MMBtu	0.01	0.01	0.01	0.01
	lb/hr	0.042	0.084	0.126	0.167
	tpy	0.18	0.37	0.55	0.73
Exhaust Data					
Temperature, F		280	295	310	325
Flow	ACFM	1,353	2,332	3,568	4,850
	SCFM	966	1,631	2,447	3,283
	lb/hr	4,343	7,338	11,006	14,675
Velocity	ft/sec	10.30	17.75	27.15	36.90
	ft/min	617.7	1064.8	1628.9	2214.2

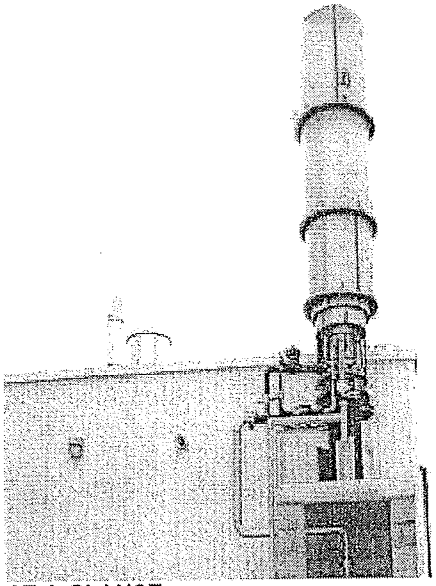
Notes: 1.) All ppm levels are corrected to 3% oxygen

2.) Fuel input is based on 80% boiler efficiency.

Submitted by: Craig Rosenberger - Craig Rosenberger

244E SERIES

Enclosed Burner and Automatic Pilot Ignition System



AT-A-GLANCE

- **No visible flame**
- **Destruction Removal Efficiencies in excess of 99%**
- **Low NOX and CO emissions**
- **Infinite Turn Down Ratio**
- **Low operating pressure**
- **No refractory lining or insulation required**
- **No motorized dampers required – air naturally introduced to the combustion process.**
- **Utilizes the same efficient and reliable 244W flamefront technology for Pilot Ignition**

The 244E enclosed burner systems are designed to burn biogas efficiently and safely over a wide range of operating parameters. With no visible flame, the 244E systems use an innovative stack design to naturally induce the proper amount of combustion air, while retaining the unique and reliable characteristics of the patented flame front pilot ignition technology.

The design of the 244E allows for complete combustion of the digester gas or landfill gas, with operating temperatures in excess of 1400 ° F (760°C). The unique stack design takes advantage of the natural draft properties of the combustion process to draw in the correct amount of air necessary to provide complete combustion. This is all done without the need for motorized dampers and complicated control systems. Independent tests have shown Destruction Removal Efficiencies (DRE) in excess of 99% and low NOX and CO emissions.

DESIGN FEATURES

- NO VISIBLE FLAME - The enclosed waste gas burner supplied has a patented design that has no visible flame.
- INFINITE TURNDOWN RATIO - The design allows biogas combustion at high efficiency without limiting the gas flow range.
- ELIMINATES COSTLY DEVICES - Air is typically introduced into the combustion process using motorized dampers, air purge blowers or PLC controlled devices. The 244E design is constructed to allow combustion air to be naturally inspirated to obtain the proper air-gas mixture, thus achieving the optimum operating temperature necessary for complete combustion to occur. The 244E's innovative combustion stack design eliminates the need for refractory lining and insulation to protect the chamber of high temperatures since cooling air is naturally induced in the stack section openings. This eliminates the need for heat shields and structures.

The 244E Enclosed Burner System is cost effective and its design makes for easy and reliable operation and maintenance.

OPERATING PRINCIPLE

Biogas is introduced via orifice burners to the combustion chamber zones. Gas is introduced into the main burner zone, and secondary burner zones are opened when the gas flow rate and pressure increases.

Air is naturally introduced from the stack base and the gaps between each stack section. The design allows for a natural introduction of air into the combustion process. The required amount of air is induced with the increase in heat release rate, thus resulting in higher combustion efficiency. The heat generated in the combustion process draws in air that allows natural cooling of tho chambor to take effect.

AUTOMATIC PILOT IGNITION SYSTEM

The 244E utilizes the same state-of-the-art, patented pilot ignition system as the 244W. Pilot gas and air are mixed and ignited at ground level, remote from the combustion stack assembly. This controlled method results in a stable pilot flame with an ideal gas-to-air ratio. It is not affected by changes in the biogas flow rate or BTU content.

Varec Biogas
A Division of Westech Industrial Inc.
6101 Ball Rd., Suite 207
Cypress, CA
90630

The unit includes an electronics package that controls pilot gas supply, ignition and monitoring. During the ignition cycle, pilot gas is diverted through the dual pilot lines. One line is referred to as the Continuous Flame Line and another smaller pilot line is referred to as the flame or ignition retention line.

Air is inspirated through venturi(s) installed in either one or both pilot lines. This stoichiometric air/gas mixture is ignited remote from the combustion stack and generates a flame front that travels to the pilot nozzle tip. The secondary pilot fuel line assists in ensuring that the flame front is not purged, and a pilot flame is established.

A thermocouple is installed in the continuous flame pilot nozzle. When the thermocouple reaches its temperature setting, the controller shuts off the flame or ignition retention line to help conserve pilot fuel consumption. A secondary thermocouple can be installed at the chamber exit to monitor stack exit temperatures.

The pilot flame continuously burns to ensure efficient combustion of the biogas. Pilot gas only continuously flows through the continuous line when there is a demand to combust biogas. Otherwise, the controls will permit burner operation in a standby mode. No pilot gas is consumed when there is no demand to combust biogas.

The ignition system also allows for automatic re-ignition in case the pilot is lost, an alarm is energized. If unsuccessful after several attempts as set in the control panel, then a second alarm is activated signaling pilot flame failure.

SPECIFICATION

A. Combustion Stack Assembly

The combustion stack assembly mounts on the burner base and is self-supporting. Lugs are provided on the stack for attachment of guy wires where necessary for additional support. The waste biogas connection is provided as ANSI 150 RF flange. The assembly includes:

a. Main Combustion Stack
b. Burner manifold
c. Continuous pilot nozzle, thermocouple and flame or ignition retention nozzle.

B. Burner Capacity

The table below is for biogas having a specific gravity 0.8 and minimum supply pressure of 4" W.C. (100 mm H_2O).

BURNER CODE	MAXIMUM FLOW RATE (SCFH)	MAXIMUM FLOW RATE (m^3/hr)
A	4167	118
B	6667	189
C	16667	472
D	25000	708
E	41667	1180
F	208333	5900

C. Combusted Gas

Biogas, primarily methane of low BTU content. Minimum inlet pressure of 4" W.C. (100 mm H2O) at flare inlet manifold.

D. Pilot Gas

1. "S" Pilot Ignition System

Type	Pressure
Propane Natural Gas	Minimum pressure of 10 PSIG (70 kPa) Maximum pressure of 100 PSIG (700 kPa)

2. "G" Pilot Ignition System

Type	Pressure
Biogas Propane* Natural Gas	Minimum pressure of 4" W.C. Maximum pressure of 14" W.C.

- If available, then specify use of a 244ES system.

E. Connections

1. Combustion Stack Assembly

All waste gas connections are ANSI 150 lb RF Flanges.

BURNER CODE	BURNER INLET SIZE
A	3" (75 mm)
B	3" (75 mm)
C	4" (100 mm)
D	6" (150 mm)
E	10" (250 mm)
F	12" (300 mm)

2. Stack Pilot Gas Connection

a) **"S" Pilot Ignition System**
   1. Continuous Pilot Nozzle - 2" NPT
   2. Flame Retention Nozzle - 1/2" NPT

b) **"G" Pilot Ignition System**
   1. Continuous Pilot Nozzle - 2" NPT
   2. Ignition Line - 1" NPT

3. Pilot Gas Supply Connection

a) **"S" Pilot Ignition System**
   1. Pilot Fuel Supply - 1/2" NPT
      i. Valve and Regulator Panel Connections. Note that Varec does not supply the pilot gas piping between the valve and regulator panel to the combustion stack.
      ii. Continuous Line
         1. Venturi Inlet – 1/2" NPT
         2. Venturi Outlet – 2" NPT
      iii. Flame Retention Line – ½" NPT

b) **"G" Pilot Ignition System**
   1. Pilot Fuel Supply - 2" NPT
      i. Valve and Regulator Panel Connections. Note that Varec does not supply the pilot gas piping between the valve and regulator panel to the combustion stack.
   ii. Continuous Line – 2" NPT
   iii. Flame Retention Line – 1" NPT

Appendix D

Air Dispersion Modeling Protocol

Air Dispersion Modeling Protocol for Glanbia Foods, Inc.

PTC Application Mod

Gooding, Idaho

Prepared for:

Glanbia Foods, Inc.

Submitted to:

Idaho Department of Environmental Quality

June 2008

Prepared By:

CH2MHILL

Project Background

Glanbia Foods, Inc. proposes to modify their cheese and whey facility in Gooding, Idaho by utilizing biogas generated from their anaerobic digester to operate Boiler No. 2 and Boiler No. 3 for steam generation. The current Permit-to-Construct (PTC) allows biogas to burn in the auxiliary boiler (Boiler No. 5) or the flare but not both concurrently.

The primary objective is to combust biogas in Boiler No. 2 and Boiler No. 3 for steam generation. Natural gas will be used in conjunction with biogas to operate Boiler No. 2 and Boiler No.3 in order to maintain production steam demands. Note that Boiler No. 2 and Boiler No. 3 are existing boilers each with an input rating of 25.1 MMBtu/hr. A biogas gun will be designed to burn up to a maximum of 12,000 standard cubic foot per hour (SCFH) or 7.8 MMBtu/hr assuming a biogas heat value of 650 BTU/SCF. Biogas combustion is approximately 30% of each boilers maximum rated input. Note that the manufacturer states that these two existing boiler will have the ability to burn biogas without a change in air discharge flows (the manufacturer information will be supplied as an attachment with the submittal of the permit application).

Additionally, Glanbia would like the operational flexibility to combust biogas for operating Boiler No. 5 concurrently with the flare. In order to give Glanbia the most operational flexibility, the modeling approach is to allow each combustion source to operate concurrently.

An air quality impact analysis will be performed in support of a Permit to Construct (PTC) required under IDAPA 58.01.01.200. Idaho regulation requires the facility applying for a PTC to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS).

This air dispersion modeling protocol is being submitted to the Idaho Department of Environmental Quality (IDEQ) for the Glanbia Foods cheese and whey facility. This document summarizes the modeling methodology that will be used to evaluate the facility's impacts to air quality with respect to particulate matter (PM) emissions. It has been prepared based on the U.S. Environmental Protection Agency (EPA) *Guidelines on Air Quality Models* (GAQM), and the *State of Idaho Air Quality Modeling Guideline* (ID AQ-01, December 31, 2002).

Project Description

This project involves an increase in biogas production ranging from 433,823 scf/day to 505,000 scf/day and the operational flexibility to combust biogas among three stationary external combustion sources and one industrial open flare.

Stack Parameters

Stack release parameters for the sources resulting in net emissions increase are identified in Table 1 for the preliminary modeling analysis. A facility layout showing the location of buildings and emissions sources will be included with the application. Stack parameters are derived from either manufacturer specifications or SCREEN3 User's Guide. Manufacturer specifications for the flare and Boilers No. 2, 3, and 5 are included as an attachment with this protocol. Typical boiler operation for Boilers No. 2, 3 and 5 is near 90% of load input capacity. Therefore, stack parameter information is based on Cleaver Brooks exhaust data operating at a firing rate of 100% of the heat input rated capacity. Note that the stack parameter information provided herein may change based upon discussions with the Idaho Department of Environmental Quality and updated in the permit application. For the flare, SCREEN3 User's Guide (EPA, 1995) was used to calculate the equivalent stack diameter and height. Additionally, the SCREEN 3 default parameters for the flare buoyancy calculation were used for stack temperature and velocity. The calculations for the adjusted flare diameter and stack height includes:

<u>Flare Equivalent Diameter and Stack Height calculations</u>

The equivalent stack diameter uses the net heat release.

$$d = 9.88 \times 10^{-4} (q_n)^{1/2}$$

The net heat release uses the heat release of the biogas from the flare

$$q_n = (0.45)\, q$$

q = gross heat release from the flare (cal/s)

qn = net heat release from the flare (cal/s)

q= Max bio gas production (505,000 scf/day) x Fuel heat value (650 BTU/scf)
= [328,250,000 BTU/day x 252 cal/BTU] / [24*3600 seconds/ day]
= 957,396 cal/s

$$q_n = 0.45 * 957{,}396 \text{ cal/s}$$
$$= 430{,}828 \text{ cal/s}$$

Now that the value for the new heat release of the biogas is determined, the equivalent diameter is

$$d = 9.88 \times 10^{-4} (430{,}828 \text{ cal/s})^{1/2}$$
$$= 0.65$$

The physical stack height of the flare is adjusted in the EPA method by adding the length of the flame to the height of the top of the flare structure using the formula:

$$H_a = H_s + [(4.56 \times 10^{-3})(q^{0.478})]$$

H_a = Adjusted flare height (m)

H_s = Physical flare height (m)

q= gross heat release (cal/s) input by user

$$H_a = 4.87 \text{ m} + [(4.56 \times 10^{-3})(957{,}396 \text{ cal/s}^{0.478})]$$
$$= 8.17 \text{ m}$$

Table 1
Stack Parameters

Stack Name	Stack ID	Stack Height (m)	Diameter (m)	Velocity (m/s)	Temperature (K)	Notes
Boiler 2	Boiler2	10.97	0.61	14.30	472.04	Manufacturer – Cleaver Brooks
Boiler 3	Bioler3	10.97	0.61	14.30	472.04	Manufacturer – Cleaver Brooks
Boiler 5	Bioler5	6.4	0.61	11.25	435.93	Manufacturer – Cleaver Brooks
Flare	Flare	8.17	0.65	20	1273	Flare diameter and height calculated using SCREEN3 User's Guide (EPA, 1995), default velocity and temperature will be used.

Estimated Emissions

A preliminary estimate of the net emission increase for each source that will be modeled is included in Table 2.0 and Table 3.0. Criteria pollutants include PM_{10}, NO_X, and SO_2; toxic air pollutants include formaldehyde, arsenic, cadmium, and nickel.

Table 2
Criteria Pollutant Net Increase

Stack Name	Stack ID	PM_{10} (lb/hr)	PM_{10} (ton/yr)	NO_x (lb/hr)	NO_x (ton/yr)	SO_2 (lb/hr)	SO_2 (ton/yr)
Boiler 2 (Combined NG + Biogas)	BOILER 2	0.08	0.47	0.84	5.0	3.55	15.54
Boiler 3 (Combined NG + Biogas)	BOILER 3	0.08	0.47	0.84	5.0	3.55	15.54
Boiler 5	BOILER 5	0.02	0.08	0.23	1.00	0.87	3.82
Flare	FLARE	0.01	0.06	0.13	0.57	5.57	24.40

Table 3
Toxic Air Pollutants

Source ID	Formaldehyde (lb/hr)	Arsenic (lb/hr)	Cadmium (lb/hr)	Nickel (lb/hr)
Boiler 2 (Combined NG + Biogas)	1.38E-03	5.68E-06	3.12E-05	5.96E-05
Boiler 3 (Combined NG + Biogas)	1.38E-03	5.68E-06	3.12E-05	5.96E-05
Boiler 5	2.22E-04	5.93E-07	3.26E-06	6.23E-06
Flare	3.47E-03	NA	NA	NA

Methodology

Standards and Criteria Levels

Table 4 summarizes applicable criteria including:

- Significant contribution levels (SCL),
- National Ambient Air Quality Standards (NAAQS).

Table 4
Regulatory Standards and Significance Levels

Pollutant	Averaging Period	National Primary AAQS		Significant Contribution Level (µg/m³)
		µg/m³	ppm	
PM_{10}	24-Hour	150		5
PM_{10}	Annual	50		1
NO_2	Annual	100	0.053	1
SO_2	Annual	80	0.03	1
SO_2	24-Hour	365	0.14	5
SO_2	3-Hour	1300	0.50	25

Modeled concentrations will be compared to the applicable Idaho significant contribution levels (SCL) shown in Table 4. If the predicted impacts are not significant (that is, less than the SCL), the modeling is complete for that pollutant under that averaging time. If impacts are significant, a more refined analysis will be conducted for demonstration of compliance with the NAAQS. If a more refined analysis is required, facility-wide emission sources in Table 5.

Table 5
NO_x and SO_2 Facility-Wide Sources

Stack Name	Stack ID	NO_x (lb/hr)	NO_x (ton/yr)	SO_2 (lb/hr)	SO_2 (ton/yr)
Boiler 1 (26.4)–NG	BOILER 1	2.50	10.95	0.01	0.07
Boiler 2 (Dual 25.1)-NG+Biogas	BOILER 2	3.22	14.12	3.56	15.59
Boiler 3 (Dual 25.1)-NG+Biogas	BOILER 3	3.22	14.12	3.56	15.59
Boiler 2 (Dual 25.1) -Diesel	BOILER 2D	3.59	1.94	1.27	0.69
Boiler 3 (Dual 25.1)- Diesel	BOILER 3D	3.59	1.94	1.27	0.69
Boiler 4 (25.1)-NG	BOILER 4	2.38	10.41	0.01	0.06
Boiler 5-(16.73)-Biogas	BOILER 5	1.62	7.07	7.66	33.56
Flare	FLARE	0.93	4.07	5.57	24.40
WPC Dryer	DRYER1	0.87	3.81	0.01	0.02
Generator	GEN1	18.23	1.82	2.88	0.29
Heater 1 (1.5)	HEAT1	0.14	0.62	0.001	0.004
Heater 2 (5.89)	HEAT2	0.56	2.44	0.003	0.01
Heater 3 ((1.374)	HEAT3	0.13	0.57	0.001	0.003
Facility-Wide Totals			**73.88**		**90.98**

A description of the modeling methodology is presented below.

Dispersion Model

The EPA-approved AERMOD (Version 07026) model will be used. AERMOD is a steady-state plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short range (< 50 km) dispersion from the source. The model incorporates the ISC Prime algorithm for modeling building downwash, which was developed to address deficiencies in the downwash algorithm previously used in the ISC model. AERMOD is designed to accept input data prepared by two specific pre-processor programs, AERMET and AERMAP. IDEQ adopted the federal mandate requiring the use of the AERMOD dispersion model for permit applications on November 9, 2006. AERMOD will be run with the following options.

- Regulatory default options,
- Direction-specific building downwash,
- Actual receptor elevations and hill height scales,
- Complex/intermediate terrain algorithms.

Building Downwash

Building influences on stacks are considered by incorporating the updated EPA Building Profile Input Program [BPIP-Prime]. The stack heights used in the dispersion modeling will be the actual stack height or Good Engineering Practice (GEP) stack height, whichever is less.

Meteorological Data

AERMET modeling files for Mini Cassia, Idaho will be used for the Gooding facility as discussed per our preliminary meeting with IDEQ on May 30, 2008. Any specific site characteristics when processing AERMET for this area will be provided by IDEQ.

AERMET accepts National Weather Service (NWS) 1-hour surface observations, NWS twice-daily upper air soundings, and data from an on-site meteorological measurement system. These data are processed in three steps. The first step extracts data from the archive data files and performs various quality assessment checks. The second step merges all available data (both NWS and on-site). These merged data are stored together in a single file. The third step reads the merged meteorological data and estimates the boundary layer parameters needed by AERMOD. AERMET writes two files for input to AERMOD: a file of hourly boundary layer parameter estimates and a file of multiple-level (when the data are available) observations of wind speed and direction, temperature, and standard deviation of the fluctuating components of the wind direction.

For all toxic air pollutants, a combined data file for all five years will be used according to IDEQ request. For all other criteria pollutants, a five sequential year data file will be used according to IDEQ request.

Ambient Conditions

Background concentrations for this facility will be provided by IDEQ. The completed Table 5 will be included with the final report.

TABLE 5
Background Criteria Pollutant Concentrations ($\mu g/m^3$)

Pollutant	1-hr	3-hr	8-hr	24-hr	Annual
NO_x					
SO_2					
PM_{10}					

Receptors

The ambient air boundary will be defined by the fence line on the south side of the plant, the Little Wood River to the east and the property boundary on the remainder of the perimeter. The non-fenced areas will be delineated with "No Trespassing" signs to limit public access to these areas. The selection of receptors in AERMOD will be as follows:

- The first run will be a 500-meter coarse grid with a nested Cartesian grid of 100 meter-spaced receptors as follows:
  - The 100-meter grid will extend approximately 1 km around the facility.
  - The 500-meter grid will extend approximately 5 km,
  - Receptors will be placed at 25-meter intervals around the fenceline.
- A second run using a fine receptor grid will be centered on the point of maximum impact and re run using a 50 meter grid spacing, unless the initial maximum occurs on the fenceline.
- Receptor elevations will be calculated by AERMAP as described below.

AERMAP will be run to process terrain elevation data for all sources and receptors using 7.5 minute Digital Elevation Model (DEM) files prepared by the USGS. AERMAP first determines the base elevation at each source and receptor. For complex terrain situations, AERMOD captures the physics of dispersion and creates elevation data for the surrounding terrain identified by a parameter called hill height scale. AERMAP creates hill height scale by searching for the terrain height and location that has the greatest influence on dispersion for each individual source and receptor. Both the base elevation and hill height scale data are produced for each receptor by AERMAP as a file or files which can be directly accessed by AERMOD.

Preliminary Analysis

The preliminary analysis for each pollutant will be conducted as follows:

- If the predicted impacts are not significant (that is, less than the SCL) for each criteria pollutant, the modeling is complete for that pollutant under that averaging time.
- If impacts are significant, a more refined analysis, as described below, will be conducted.

Refined Analyses – Criteria Pollutants

- Comparison to the Ambient Air Quality Standards
  - For pollutants with concentrations greater than the SCLs, the maximum concentration will be determined and compared to the NAAQS. This maximum concentration will include contributions from the facility, nearby sources, and ambient background concentrations. Background concentrations to be provided by IDEQ will be used to determine concentrations.
  - IDEQ will be contacted to identify nearby sources, if any, that need to be included in the analysis.

Output - Presentation of Results

The results of the air dispersion modeling analyses will be presented as follows:

- A description of modeling methodologies and input data,
- A summary of the results in tabular and, where appropriate, graphical form,
- Modeling files used by AERMOD will be provided with the application on compact disk,
- Any deviations from the methodology proposed in this protocol will be presented.

References

EPA, SCREEN3, Model User's Guide, EPA 454/B-95-004, September 1995

Appendix E

Modeling Results

Net Increase Criteria Pollutant Impacts - Preliminary Modeling Results

Pollutant	Averaging Period	NAAQS (ug/m^3)	Significant Impact Analysis (ug/m^3)	Significant Contribution Level (ug/m^3)	Exceeds SCL
PM_{10} [a]	24 Hour	150	1.67939	5	No
PM_{10}	Annual	50	0.35985	1	No
NO_2	Annual	100	4.03458	1	Yes
SO_2	Annual	80	12.82831	1	Yes
SO_2	24 Hour	365	158.82179	5	Yes
SO_2	3 Hour	1300	472.35794	25	Yes

Notes:

[a] 2nd high was used for PM_{10} 24-hr averaging period

Net Increase Toxic Air Pollutant Impacts

Pollutant	Net Increase Impacts (ug/m^3)	AACC (ug/m^3)	Exceeds AACC
Arsenic	2.00E-05	2.30E-04	No
Cadmium	1.00E-04	5.60E-04	No
Formaldehyde	4.85E-03	7.70E-02	No
Nickel	2.00E-04	4.20E-03	No

Facility-Wide Criteria Pollutant Impacts - Refined Modeling Results

Pollutant	Averaging Period	Background Concentration (ug/m^3)	Full Impact Results (ug/m^3)	Total Ambient Impact (ug/m^3)	NAAQS (ug/m^3)	Exceeds NAAQS	Year	Location	
								East(X)	North(Y)
NO_2	Annual	32	18.79	50.79	100	No	2003	693037.62	4757860.5
SO_2	Annual	8	22.97	30.97	80	No	2001	693554.69	4757946
SO_2	24 Hour	26	218.11	244.11	365	No	2002	693382.81	4757951
SO_2	3 Hour	42	649.60	691.60	1300	No	2000	693385.88	4757954

Appendix F

Regulatory Requirements

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

13 JUL 2005

Reply To
Attn Of: AWT - 107

Mr. Todd J. Hughes
Environmental Manager
Glanbia Foods Inc.
1728 South 2300 East
Gooding, Idaho 83330

Re: NSPS Subpart Dc Reduction in Fuel Use Record-Keeping Request

Dear Mr. Hughes:

This alternative fuel monitoring determination is in response to a request sent to the Environmental Protection Agency (EPA) by Glanbia Foods, Inc. (Glanbia) dated December 22, 2004. In this request, it is stated that Glanbia intends to maintain and operate five boilers, located at their facility in Gooding, Idaho. Four of these boilers are affected facilities subject to 40 CFR 60 Subpart Dc "Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units" (Subpart Dc) and also subject to certain general requirements of 40 CFR 60 Subpart A.

EPA approves the request from Glanbia for a reduction in the fuel usage record-keeping requirement in 40 CFR §60.48c of Subpart Dc from daily to monthly for Boilers 2, 3, and 4. EPA denies the reduction in the fuel usage record-keeping requirement in 40 CFR §60.48c for Boiler 5 and describes what is necessary in order to approve this for the biogas-fueled Boiler 5. EPA also approves the use of one gas meter to record monthly natural gas usage for Boilers 2, 3, and 4.

The five boilers at Glanbia's Gooding facility are of various sizes, fuels, and installation dates as follows:

- Boiler 1 is a 29.35 MMBtu/hr Continental E Series, fueled exclusively by natural gas and installed in 1979. Therefore, it is not subject to Subpart Dc, which has an applicability date of June 9, 1989.
- Boilers 2 and 3 are 25.1 MMBtu/hr Cleaver Brooks, duel-fired boilers, installed in 1992 and 1996, respectively. They operate on natural gas as the primary fuel with No. 2 diesel fuel as backup.
- Boiler 4 is also a 25.1 MMBtu/hr Cleaver Brooks boiler, but is fueled exclusively by natural gas and was installed in 1999.
- Boiler 5 is a 16.7 MMBtu/hr Cleaver Brooks boiler. It is fueled by biogas from the Wastewater Treatment effluent process as the primary fuel and can burn natural gas as a backup. It was installed in February 2005.

Glanbia has requested to reduce the record-keeping requirement of 40 CFR §60.48c. They request approval to record the amount of each fuel combusted in Boilers 2-5 during each month instead of during each day as required by Subpart Dc. Boiler 5 is in a separate building from Boilers 1-4 and Boiler 5 will have a separate natural gas and biogas meter to measure the fuel used by Boiler 5 on a monthly basis. Glanbia proposes to have one gas meter for Boilers 2, 3, and 4 that will measure the total natural gas usage per month. When more than one boiler is firing natural gas simultaneously, they will divide each boiler design heat input capacity by the total of the design heat input capacities of each boiler, and use this to prorate the natural gas usage of each boiler on a monthly basis. For boilers 2 and 3, which are capable of firing low sulfur diesel fuel, each boiler will maintain individual fuel oil meters. EPA determines that this will adequately determine the fuel usage by each boiler.

The approval for the reduction in the record keeping to monthly instead of daily is based on a memorandum dated February 20, 1992, from the EPA Office of Air Quality Planning and Standards which states that

> There is little value in requiring daily record-keeping of the amounts of fuel combusted for an affected unit that fires only natural gas or natural gas with clean low-sulfur fuel oil (sulfur content less than 0.5%) as a backup.

EPA has approved requests for such units to maintain monthly, instead of daily, fuel records. EPA thus approves the reduction in record-keeping from daily to monthly for boilers 2-4 which fire only natural gas or natural gas with clean low-sulfur fuel oil (sulfur content less than 0.5%) as a backup. For units that fire oil there are additional certification requirements that the fuel oil sulfur limits of 0.5% are met. Therefore, EPA's approvals of monthly fuel use record-keeping for units that can fire oil have continued to require semi-annual reporting of excess emissions of the standards for sulfur dioxide, which are in 40 CFR § 60.42c(d) and § 60.42c(h)(1)), and required by 40 CFR § 60.48c(d). Those reports must be consistent with the general excess emissions reporting requirements of 40 CFR § 60.7(d).

Boiler 5 meets the basic applicability requirements of Subpart Dc based on the date of construction and the size, regardless of the fuel that is combusted, but similar to the use of natural gas, the use of biogas is not addressed with any requirements associated with the standards for sulfur dioxide or the standards for particulate matter, which are the only pollutants with standards in Subpart Dc. The record-keeping requirement of 40 CFR 60.48c(g) requires records of the amounts of <u>each fuel</u> combusted during each day (emphasis added). The decision to reduce this requirement for certain boilers is based on the assumption that that fuel has low sulfur content. The sulfur content of natural gas is well known, however, the use of biogas in the context of this regulation has not been addressed before and it is uncertain what the sulfur content of Glanbia's biogas is. After consultation with EPA headquarters Office of Enforcement and Compliance Assurance (OECA), EPA has concluded that the sulfur content of the biogas must be evaluated and determined to be less than 0.5% with little variability before the reduction in recordkeeping to Boiler 5 can be approved. Once the low sulfur content of the fuel has been demonstrated, the reduction in the record-keeping for Boiler 5 can be approved. Until then, 40 CFR 60.58c(g) must be followed for Boiler 5.

If you have any further questions or concerns, please contact Heather Valdez of the Region 10 Office of Air, Waste and Toxics at (206) 553-6220 or valdez.heather@epa.gov.

Sincerely,

Jeff KenKnight

Jeff KenKnight, Manager
Federal and Delegated Air Programs Unit
Office of Air, Waste and Toxics

cc: Bill Rogers, Idaho Department of Environmental Quality, Boise
Darrin Mehr, Idaho Department of Environmental Quality, Boise
Stephen VanZandt, Idaho Department of Environmental Quality, Twin Falls

TABLE F-1

Compliance with IDAPA Rule 676 PM Standard for Fuel Burning Equipment			
Unit	**Nos. 2 and 3 Dual-Fueled Boilers**		**Biogas Boiler**
Fuel	**Natural Gas**	**Biogas**	**Biogas**
Rated Heat Input (MM Btu/hr)	17.30	7.80	16.74
PM Emission Rate (lb/hr)	0.17	0.09	0.17
Exit/Flue Gas Flowrate Calculation			
F_d (Table 19-2, EPA Method 19) (dscf/MM Btu) [1,2]	8,710	8,710	8,710
Exit flowrate @ 0% O_2: (dscfm)	2,511	2,511	2,430
Exit flowrate @ 3% O_2: (dscfm) [3]	2,932	2,932	2,837
Calculated Grain Loading (gr/dscf @ 3% O_2) [4]	0.007	0.004	0.007
PM Loading Standard (IDAPA 58.01.01.676) (gr/dscf @ 3% 02) (0.015 for gas, 0.05 for liquid)	0.015	0.015	0.015
Compliance w/ PM Loading Standard	**Yes**	**Yes**	**Yes**

[1] Appendix A-7 to 40 CFR part 60, Method 19—Determination of sulfur dioxide removal efficiency and particulate, sulfur dioxide and nitrogen oxides emission rates, Table 19-2 (F Factors for Various Fuels)

[2] F_d, Volumes of combustion components per unit of heat content (scf/million Btu). On a Btu basis, F_d for all gaseous fuels (i.e., natural gas, propane, and butane) is identical (8,710 dscf/ MM Btu). F_d for biogas (which is primarily methane, or natural gas) was set at 8,710 dscf/MM Btu.

[3] $(\text{Flow}_{3\%}) = (\text{Flow}_{0\%}) \text{x} (20.9/(20.9 - 3))$, where 20.9 = Oxygen concentration in ambient air

[4] (Flow (dscfm) x (7,000 gr/lb) x (PM lb/hr) x (60 min/ hr) = gr/dscf

TABLE F-2

Compliance with IDAPA Rule 786 PM Standard for Incineration

Biogas combustion rate (scfm)[1]	301
Biogas methane content	65%
Methane density (lb/ft^3)[2]	0.0448
Hourly methane combustion rate ("refuse" lb/hr)[3]	526
Flare PM emission rate (lb/hr)[1]	0.085
PM emission rate (lb PM/lb refuse)	0.0001606
PM emission rate (lb PM/ 100 lb refuse)	0.01606
IDAPA 58.01.01.786.01 standard (lb PM / 100 lb refuse)	0.2
Compliance with IDAPA standard	Yes

1 Pharmer Engineering (2005) - Engineer's estimate (anaerobic digester)

2 Perry's Chemical Engineers' Handbook, Sixth Edition, Table 3-20

3 (Biogas combustion (scfm)) x (60 min/hr) x (methane %)

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

1410 North Hilton
Boise, Idaho 83706-1253

RECEIPT

DATE: 7/15/08

RECEIVED FROM: Glanbia

SOURCE: Cash ☐ Check ☒ Money Order ☐ No. ____

DESCRIPTION	AMOUNT OF PAYMENT
PTC check # 1110 018518	1 000 00
Glanbia Gooding Facility	

RECEIVED BY ____

TOTAL RECEIVED: 1000 00

PID	OBS	CA	SUB-OBJ	WP	BE

Nº 82872